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Modeling poling processes in ferroelectric devices taking into account weak electric conductivity

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ABSTRACT

Ferroelectrics are used to generate a displacement or force by applying an electric voltage. The underlying so-called piezoelectric effect is a coupling between electric field and strain. Being a polycrystalline material, piezoelectric properties have to be induced by the so-called poling process. This process may lead to a remanent polarization field which is not divergence free, in general. As a consequence, severe electric depolarization fields may occur. On the other hand, it is well known that ferroelelctrics possess a so-called weak electric conductivity, i.e., they are no perfect insulators. In lead-free ferroelectrics, this effect is even more pronounced than classical lead-based actuator soft-PZT materials.